

# SEQUENCE LISTING

<110> The Scripps Research Institute  
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Cropp, T Ashton  
Anderson, J Christopher  
Schultz, Peter G

<120> EXPANDING THE EUKARYOTIC GENETIC CODE

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<170> PatentIn version 3.3

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<220>  
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<212> DNA  
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 <213> artificial  
  
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 ggcggcgcgga cgggtctgat tggcgacccg agcttcaagg ctgccgagcg taagctgaac 240  
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cgtcgtctgc	atcagaatca	ggtg				624

<210> 18  
 <211> 609  
 <212> DNA  
 <213> artificial

<220>  
 <223> artificial synthetase

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gaaaactctg	ctatcgcggc caataattat gactggttcg gcaatatgaa tgtgctgacc 360
ttcctgcgcg	atattggcaa acacttctcc gttaaccaga tgatcaacaa agaagcgggt 420
aagcagcgtc	tcaaccgtga agatcagggg atttcgttca ctgagttttc ctacaacctg 480
ctgcagggtt	atggttttgc ctgtttgaac aaacagtacg gtgtgggtgct gcaaattggg 540
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aatcaggtg	

<210> 19  
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 <212> DNA  
 <213> artificial

<220>  
 <223> artificial synthetase

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aaacacttct ccgttaacca gatgatcaac aaagaagcgg ttaagcagcg tctcaaccgt 420
gaagatcagg ggatttcggt cactgagttt tcctacaacc tgctgcaggg ttatggttat 480
gcctgtatga acaaacagta cgggtgtggtg ctgcaaattg gtggttctga ccagtggggg 540
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<210> 20
<211> 621
<212> DNA
<213> artificial

<220>
<223> artificial synthetase

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<220>
<221> misc_feature
<222> (26)..(26)
<223> n is a, c, g, or t

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<220>
<221> misc_feature
<222> (612)..(612)
<223> n is a, c, g, or t

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<220>
<221> misc_feature
<222> (618)..(618)
<223> n is a, c, g, or t

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ccattgttat gcctgaaacg cttccagcag gcggggccaca agccggttgc gctggtaggc 180
ggcgcgacgg gtctgattgg cgacccgagc ttcaaagctg ccgagcgtaa gctgaacacc 240
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ttcgactgtg gagaaaactc tgctatcgcg gccaataatt atgactgggt cggcaatatg 360
aatgtgctga ccttcctgcg cgatattggc aaacacttct ccgttaacca gatgatcaac 420
aaagaagcgg ttaagcagcg tctcaaccgt gaagatcagg ggatttcggt cactgagttt 480
tcctacaacc tgctgcaggg ttattctatg gcctgtgcga acaaacagta cgggtgtggtg 540
ctgcaaattg gtggttctga ccagtggggg aacatcactt ctggtatcga cctgaccgct 600
cgtctgcatc anaatcangt g 621

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<210> 21  
 <211> 588  
 <212> DNA  
 <213> artificial  
  
 <220>  
 <223> artificial synthetase  
  
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 ggccacaagc cggttgcgct ggtaggcggc gcgacgggtc tgattggcga cccgagcttc 180  
 aaagctgccg agcgtaagct gaacaccgaa gaaactgttc aggagtgggt ggacaaaatc 240  
 cgtaagcagg ttgccccgtt cctcgatttc gactgtggag aaaactctgc tatcgcgggc 300  
 aataattatg actggttcgg caatatgaat gtgctgacct tcctgcgcga tattggcaaa 360  
 cacttctccg ttaaccagat gatcaacaaa gaagcgggta agcagcgtct caaccgtgaa 420  
 gatcagggga tttcgttcac tgagttttcc tacaacctgc tgcaggggta ttctgcgggc 480  
 tgtgcgaaca aacagtacgg tgtggtgctg caaattgggtg gttctgacca gtggggtaac 540  
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<210> 22  
 <211> 600  
 <212> DNA  
 <213> artificial  
  
 <220>  
 <223> artificial synthetase

<220>  
 <221> misc\_feature  
 <222> (403)..(403)  
 <223> n is a, c, g, or t

<220>  
 <221> misc\_feature  
 <222> (513)..(513)  
 <223> n is a, c, g, or t

<220>  
 <221> misc\_feature  
 <222> (515)..(515)  
 <223> n is a, c, g, or t

<220>  
 <221> misc\_feature  
 <222> (518)..(518)  
 <223> n is a, c, g, or t

<220>  
 <221> misc\_feature  
 <222> (531)..(531)  
 <223> n is a, c, g, or t

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ttccagcagg cgggccacaa gccggttgcg ctggtaggcg gcgcgacggg tctgattggc 180  
gacccgagct tcaaagctgc cgagcgtaag ctgaacaccg aagaaactgt tcaggagtgg 240  
gtggacaaaa tccgtaagca ggttgccccg ttctctgatt tcgactgtgg agaaaactct 300  
gctatcgcg ccaataatta tgactgggtt ggcaatatga atgtgctgac cttcctgcgc 360  
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ctcaaccgtg aagatcaggg gatttcgttc actgagtttt cctacaacct gctgcagggt 480  
tattcggctg cctgtgcaa caaacagtac ggngngngnc tgcaaattgg nggttctgac 540  
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<210> 23  
<211> 591  
<212> DNA  
<213> artificial

<220>  
<223> artificial synthetase

<220>  
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<222> (588)..(588)  
<223> n is a, c, g, or t

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gcgggccaca agccggttgc gctggtaggc ggcgcgacgg gtctgattgg cgacccgagc 180  
ttcaaagctg ccgagcgtaa gctgaacacc gaagaaactg ttcaggagtg ggtggacaaa 240  
atccgtaagc aggttgcccc gttcctcgat ttcgactgtg gagaaaactc tgctatcgcg 300  
gccaataatt atgactgggt cggcaatatg aatgtgctga cttcctgcgc cgatattggc 360  
aaacacttct ccgttaacca gatgatcaac aaagaagcgg ttaagcagcg tctcaaccgt 420  
gaagatcagg ggatttcgtt cactgagttt tcctacaacc tgctgcaggg ttatagtgcg 480  
gcctgtgtta acaaacagta cgggtgtgtg ctgcaaattg gtggttctga ccagtggggg 540  
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<210> 24  
<211> 600  
<212> DNA  
<213> artificial

<220>  
<223> artificial synthetase

<400> 24  
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ttccagcagg cgggccacaa gccggttgcg ctggtaggcg gcgcgacggg tctgattggc 180  
gacccgagct tcaaagctgc cgagcgtaag ctgaacaccg aagaaactgt tcaggagtgg 240  
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gctatcgcg ccaatgatta tgactgggtc ggcaatatga atgtgctgac cttctgcg 360  
gatattggca aacacttctc cgtaaccag atgatcaaca aagaagcggg taagcagcgt 420  
ctcaaccgtg aagatcaggg gatttcgttc actgagtttt cctacaacct gctgcagggt 480  
tataattttg cctgtgtgaa caaacagtac ggtgtggtgc tgcaaattgg tggttctgac 540  
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<210> 25  
<211> 579  
<212> DNA  
<213> artificial

<220>  
<223> artificial synthetase

<400> 25  
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ccggttgcg tggtaggcg cgcgacgggt ctgattggcg acccgagctt caaagctgcc 180  
gagcgtaagc tgaacaccga agaaactgtt caggagtggg tggacaaaat ccgtaagcag 240  
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gactgggttcg gcaatatgaa tgtgctgacc ttctgcgcg atattggcaa acacttctcc 360  
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<210> 26  
<211> 624  
<212> DNA  
<213> artificial

<220>  
<223> artificial synthetase

<220>  
<221> misc\_feature  
<222> (13)..(13)



<223> n is a, c, g, or t

<220>

<221> misc\_feature

<222> (599)..(599)

<223> n is a, c, g, or t

<400> 26

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gttccattgt tatgcctgaa acgcttccag caggcggggcc acaagccggt tgcgctggta	180
ggcggcgcgga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac	240
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gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat	360
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gtgctgcaaa ttggtggttc tgaccagtgg ggtaacatca cttctggtat cgacctganc	600
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<210> 27

<211> 625

<212> DNA

<213> artificial

<220>

<223> artificial synthetase

<220>

<221> misc\_feature

<222> (600)..(600)

<223> n is a, c, g, or t

<400> 27

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gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat	360
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aacaaagaag cggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag	480
ttttcctaca atctgctgca gggttattcg gctgcctgtc ttaacaaaca gtacggtgtg	540
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625

<210> 28

<211> 624

<212> DNA

<213> artificial

<220>

<223> artificial synthetase

<400> 28

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gttccattgt tatgcctgaa acgcttccag caggcaggcc acaagccggt tgcgctggta 180

ggcggcgca cggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240

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gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360

atgaatgtgc tgaccttctt gcgcgatatt ggcaaact tctccgtaa ccagatgac 420

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cgctcgtctg atcagaatca ggtg 624

<210> 29

<211> 624

<212> DNA

<213> artificial

<220>

<223> artificial synthetase

<400> 29

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ccgatcgac tcgctgtag cttcgatcct accgctgaca gcttgcatctt ggggcatctt 120

gttccattgt tatgcctgaa acgcttccag caggcgggccc acaagccggt tgcgctggta 180

ggcggcgca cggtctgat tggcgacccg agcttcaagg ctgccgagcg taagctgaac 240

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cgtcgtctgc atcagaatca ggtg

624

<210> 30

<211> 624

<212> DNA

<213> artificial

<220>

<223> artificial synthetase

<400> 30

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gttcattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180

ggcggcgca cgggtctgat tggcgaccg agcttcaaag ctgccgagcg taagctgaac 240

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gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360

atgaatgtgc tgaccttctt gcgcgatatt ggcaaact tctccgtaa ccagatgac 420

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cgtcgtctgc atcagaatca ggtg 624

<210> 31

<211> 624

<212> DNA

<213> artificial

<220>

<223> artificial synthetase

<400> 31

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ccgatcgac tcacgtgtgg cttcgatcct accgctgaca gcttgcattt ggggcatctt 120

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ggcggcgca cgggtctgat tggcgaccg agcttcaaag ctgccgagcg taagctgaac 240

accgaagaaa ctgttcagga gtgggtggac aaaatccgta agcagggtgc cccgttcctc 300

gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360

atgaatgtgc tgaccttctt gcgcgatatt ggcaaact tctccgtaa ccagatgac 420

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 aaacgcttcc agcaggcggg ccacaagccg gttgcgctgg taggcggcgc gacgggtctg 180  
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 gagtgggtgg acaaaatccg taagcaggtt gccccgttcc tcgatttcga ctgtggagaa 300  
 aactctgcta tcgcggccaa taattatgac tggttcggca atatgaatgt gctgaccttc 360  
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 cagcgtctca accgtgaaga tcaggggatt tcgttccactg agttttccta caatctgctg 480  
 cagggttatt cggctgcctg tcttaacaaa cagtacgggtg tgggtgctgca aattgggtgg 540  
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 gttccattgt tatgcctgaa acgcttccag caggcgggcc acaagccggt tgcgctggta 180  
 ggcggcgcga cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240  
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 gatttcgact gtggagaaaa ctctgctatc gcggccaata attatgactg gttcggcaat 360  
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 gttccattgt tatgcctgaa acgcttccag caggcggggc acaagccggt tgcgctggta 180  
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 gttccattgt tatgcctgaa acgcttccag caggcggggc acaagccggt tgcgctggta 180  
 ggcggcgca cgggtctgat tggcgacccg agcttcaaag ctgccgagcg taagctgaac 240  
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 aacaaagaag cgggttaagca gcgtctcaac cgtgaagatc aggggatttc gttcactgag 480  
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Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Ser Tyr Ala Cys Leu Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
Page 22

195	200	205
Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr 210 215 220		
Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu 225 230 235 240		
Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe 245 250 255		
Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu 260 265 270		
Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu 275 280 285		
Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala 290 295 300		
Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala 305 310 315 320		
Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser 325 330 335		
Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu 340 345 350		
Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu 355 360 365		
Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile 370 375 380		
Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu 385 390 395 400		
Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys 405 410 415		
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<223> artificial synthetase

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Pro Ile Ala Leu Ile Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Leu Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe



245 250 255  
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
 260 265 270  
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
 275 280 285  
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
 290 295 300  
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
 305 310 315 320  
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
 325 330 335  
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
 340 345 350  
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
 355 360 365  
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
 370 375 380  
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
 385 390 395 400  
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
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 Asn Tyr Cys Leu Ile Cys Trp Lys  
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<400> 38

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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
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Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Ala Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
Page 26

290		295		300
Glu Gln Val Thr Arg	Leu Val His Gly Glu	Glu Gly Leu Gln Ala Ala		
305	310	315		320
Lys Arg Ile Thr	Glu Cys Leu Phe Ser	Gly Ser Leu Ser Ala Leu Ser		
	325	330		335
Glu Ala Asp	Phe Glu Gln Leu Ala	Gln Asp Gly Val Pro Met Val Glu		
	340	345		350
Met Glu Lys	Gly Ala Asp Leu Met	Gln Ala Leu Val Asp Ser Glu Leu		
	355	360		365
Gln Pro Ser Arg	Gly Gln Ala Arg Lys Thr	Ile Ala Ser Asn Ala Ile		
	370	375		380
Thr Ile Asn	Gly Glu Lys Gln Ser Asp	Pro Glu Tyr Phe Phe Lys Glu		
385	390	395		400
Glu Asp Arg	Leu Phe Gly Arg Phe Thr	Leu Leu Arg Arg Gly Lys Lys		
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Asn Tyr Cys	Leu Ile Cys Trp Lys			
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Ala Gln Val	Thr Asp Glu Glu Ala	Leu Ala Glu Arg Leu Ala Gln Gly		
	20	25		30
Pro Ile Ala	Leu Val Cys Gly Phe	Asp Pro Thr Ala Asp Ser Leu His		
	35	40		45
Leu Gly His	Leu Val Pro Leu Leu Cys	Leu Lys Arg Phe Gln Gln Ala		
	50	55		60
Gly His Lys	Pro Val Ala Leu Val Gly	Gly Ala Thr Gly Leu Ile Gly		
65	70	75		80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Leu Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
Page 28

340 345 350  
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
 355 360 365  
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
 370 375 380  
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
 385 390 395 400  
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 Asn Tyr Cys Leu Ile Cys Trp Lys  
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 Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
 35 40 45  
 Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
 50 55 60  
 Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65 70 75 80  
 Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
 85 90 95  
 Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
 100 105 110  
 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Thr Met Ala Cys Leu Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
Page 30

385                      390                      395                      400  
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
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 Asn Tyr Cys Leu Ile Cys Trp Lys  
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                          20                      25                      30  
 Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
                          35                      40                      45  
 Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
                          50                      55                      60  
 Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65                      70                      75                      80  
 Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
                          85                      90                      95  
 Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
                          100                      105                      110  
 Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
                          115                      120                      125  
 Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
                          130                      135                      140  
 His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
 145                      150                      155                      160  
 Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
                          165                      170                      175

Leu Leu Gln Gly Tyr Thr Tyr Ala Cys Leu Asn Lys Gln Tyr Gly Val  
 180 185 190  
 Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
 195 200 205  
 Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
 210 215 220  
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
 225 230 235 240  
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
 245 250 255  
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
 260 265 270  
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
 275 280 285  
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
 290 295 300  
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
 305 310 315 320  
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
 325 330 335  
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
 340 345 350  
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
 355 360 365  
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
 370 375 380  
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
 385 390 395 400  
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
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 Asn Tyr Cys Leu Ile Cys Trp Lys  
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<223> artificial synthetase

<400> 42

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Pro Ile Ala Leu Leu Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Ser Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
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Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys  
420

<210> 43  
<211> 424  
<212> PRT  
<213> artificial

<220>  
<223> artificial synthetase

<400> 43

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
 20 25 30

Pro Ile Ala Leu Leu Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
 165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Ala Asn Lys Gln Tyr Gly Val  
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys  
420

<210> 44  
<211> 424  
<212> PRT  
<213> artificial

<220>  
<223> artificial synthetase

<400> 44

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
20 25 30

Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
 165 170 175

Leu Leu Gln Gly Tyr Arg Met Ala Cys Leu Asn Lys Gln Tyr Gly Val  
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys  
 420

<210> 45  
 <211> 424  
 <212> PRT  
 <213> artificial

<220>  
 <223> artificial synthetase

<400> 45

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
 20 25 30

Pro Ile Ala Leu Ile Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
 165 170 175

Leu Leu Gln Gly Tyr Gly Met Ala Cys Ala Asn Lys Gln Tyr Gly Val  
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys  
 420

<210> 46

<211> 424

<212> PRT

<213> artificial

<220>

<223> artificial synthetase

<400> 46

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
 20 25 30

Pro Ile Ala Leu Gly Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
 145 150 155 160



Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
 165 170 175

Leu Leu Gln Gly Tyr Gly Phe Ala Cys Ala Asn Lys Gln Tyr Gly Val  
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys  
420

<210> 47  
<211> 424  
<212> PRT  
<213> artificial

<220>  
<223> artificial synthetase

<400> 47

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
20 25 30

Pro Ile Ala Leu Gly Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Gly Tyr Ala Cys Met Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
 210 215 220  
 Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
 225 230 235 240  
 Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
 245 250 255  
 Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
 260 265 270  
 Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
 275 280 285  
 Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
 290 295 300  
 Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
 305 310 315 320  
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
 325 330 335  
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
 340 345 350  
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
 355 360 365  
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
 370 375 380  
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
 385 390 395 400  
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
 405 410 415  
 Asn Tyr Cys Leu Ile Cys Trp Lys  
 420

<210> 48  
 <211> 424  
 <212> PRT  
 <213> artificial  
 <220>  
 <223> artificial synthetase

<400> 48

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
20 25 30

Pro Ile Ala Leu Leu Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Ala Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys  
420

<210> 49  
<211> 424  
<212> PRT  
<213> artificial

<220>  
<223> artificial synthetase

<400> 49

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
20 25 30

Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
 165 170 175

Leu Leu Gln Gly Tyr Ser Ala Ala Cys Ala Asn Lys Gln Tyr Gly Val  
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys  
 420

<210> 50  
 <211> 424  
 <212> PRT  
 <213> artificial

<220>  
 <223> artificial synthetase

<400> 50

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
 20 25 30

Pro Ile Ala Leu Leu Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Ser Ala Ala Cys Ala Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
340 345 350



Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys  
420

<210> 51  
<211> 424  
<212> PRT  
<213> artificial

<220>  
<223> artificial synthetase

<400> 51

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
20 25 30

Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
 165 170 175

Leu Leu Gln Gly Tyr Ser Ala Ala Cys Val Asn Lys Gln Tyr Gly Val  
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
 260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
 275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
 290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
 305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
 325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
 340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
 355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
 385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
 405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys  
 420

<210> 52  
 <211> 424  
 <212> PRT  
 <213> artificial

<220>  
 <223> artificial synthetase

<400> 52

Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
 1 5 10 15

Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
 20 25 30

Pro Ile Ala Leu Ile Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asp Tyr Asp  
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
 165 170 175

Leu Leu Gln Gly Tyr Asn Phe Ala Cys Val Asn Lys Gln Tyr Gly Val  
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
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Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
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Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
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Asn Tyr Cys Leu Ile Cys Trp Lys  
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
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Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
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Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
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Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Ser Ala Ala Cys Leu Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys  
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Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
Page 54

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Pro	Ile	Ala	Leu	Gly	Cys	Gly	Phe	Asp	Pro	Thr	Ala	Asp	Ser	Leu	His
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Leu	Gly	His	Leu	Val	Pro	Leu	Leu	Cys	Leu	Lys	Arg	Phe	Gln	Gln	Ala
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Gly	His	Lys	Pro	Val	Ala	Leu	Val	Gly	Gly	Ala	Thr	Gly	Leu	Ile	Gly
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Asp	Pro	Ser	Phe	Lys	Ala	Ala	Glu	Arg	Lys	Leu	Asn	Thr	Glu	Glu	Thr
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Val	Gln	Glu	Trp	Val	Asp	Lys	Ile	Arg	Lys	Gln	Val	Ala	Pro	Phe	Leu
			100					105					110		
Asp	Phe	Asp	Cys	Gly	Glu	Asn	Ser	Ala	Ile	Ala	Ala	Asn	Asn	Tyr	Asp
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Trp	Phe	Gly	Asn	Met	Asn	Val	Leu	Thr	Phe	Leu	Arg	Asp	Ile	Gly	Lys
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His	Phe	Ser	Val	Asn	Gln	Met	Ile	Asn	Lys	Glu	Ala	Val	Lys	Gln	Arg
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Leu	Asn	Arg	Glu	Asp	Gln	Gly	Ile	Ser	Phe	Thr	Glu	Phe	Ser	Tyr	Asn
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Leu	Leu	Gln	Gly	Tyr	Ser	Met	Ala	Cys	Leu	Asn	Lys	Gln	Tyr	Gly	Val
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Val	Leu	Gln	Ile	Gly	Gly	Ser	Asp	Gln	Trp	Gly	Asn	Ile	Thr	Ser	Gly
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Ile	Asp	Leu	Thr	Arg	Arg	Leu	His	Gln	Asn	Gln	Val	Phe	Gly	Leu	Thr
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Val	Pro	Leu	Ile	Thr	Lys	Ala	Asp	Gly	Thr	Lys	Phe	Gly	Lys	Thr	Glu
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Gly	Gly	Ala	Val	Trp	Leu	Asp	Pro	Lys	Lys	Thr	Ser	Pro	Tyr	Lys	Phe
				245					250					255	
Tyr	Gln	Phe	Trp	Ile	Asn	Thr	Ala	Asp	Ala	Asp	Val	Tyr	Arg	Phe	Leu
			260					265					270		
Lys	Phe	Phe	Thr	Phe	Met	Ser	Ile	Glu	Glu	Ile	Asn	Ala	Leu	Glu	Glu
		275					280					285			

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
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Asn Tyr Cys Leu Ile Cys Trp Lys  
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
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Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
Page 56



65	70	75	80
Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr	85	90	95
Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu	100	105	110
Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp	115	120	125
Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys	130	135	140
His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg	145	150	155
Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn	165	170	175
Leu Leu Gln Gly Tyr Ser Ala Ala Cys Leu Asn Lys Gln Tyr Gly Val	180	185	190
Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly	195	200	205
Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr	210	215	220
Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu	225	230	235
Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe	245	250	255
Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu	260	265	270
Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu	275	280	285
Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala	290	295	300
Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala	305	310	315
Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser	325	330	335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
385 390 395 400

Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
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Asn Tyr Cys Leu Ile Cys Trp Lys  
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
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Pro Ile Ala Leu Ser Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
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Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
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Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
Page 58



Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
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Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
405 410 415

Asn Tyr Cys Leu Ile Cys Trp Lys  
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Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
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Pro Ile Ala Leu Ala Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
Page 60



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Met Ala Ser Ser Asn Leu Ile Lys Gln Leu Gln Glu Arg Gly Leu Val  
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
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Pro Ile Ala Leu Ala Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
 165 170 175

Leu Leu Gln Gly Tyr Thr Met Ala Cys Cys Asn Lys Gln Tyr Gly Val  
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr

210		215		220
Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu				
225		230		240
Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe				
	245		250	255
Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu				
	260		265	270
Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu				
	275		280	285
Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala				
	290		295	300
Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala				
305		310		315
Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser				
	325		330	335
Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu				
	340		345	350
Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu				
	355		360	365
Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile				
	370		375	380
Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu				
385		390		395
Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys				
	405		410	415
Asn Tyr Cys Leu Ile Cys Trp Lys				
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
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Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
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Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
 145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
 165 170 175

Leu Leu Gln Gly Tyr Thr Phe Ala Cys Met Asn Lys Gln Tyr Gly Val  
 180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
 195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
 210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
 225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
 245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
 Page 64



260	265	270
Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu		
275	280	285
Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala		
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Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala		
305	310	315
Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser		
325	330	335
Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu		
340	345	350
Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu		
355	360	365
Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile		
370	375	380
Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu		
385	390	395
Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys		
405	410	415
Asn Tyr Cys Leu Ile Cys Trp Lys		
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly		
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Pro Ile Ala Leu Thr Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His		
35	40	45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Ser Val Ala Cys Leu Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
Page 66

305                      310                      315                      320  
 Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
                          325                      330                      335  
 Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
                          340                      345                      350  
 Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
                          355                      360                      365  
 Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
                          370                      375                      380  
 Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
 385                      390                      395                      400  
 Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
                          405                      410                      415  
 Asn Tyr Cys Leu Ile Cys Trp Lys  
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                          20                      25                      30  
 Pro Ile Ala Leu Val Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
                          35                      40                      45  
 Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
                          50                      55                      60  
 Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65                      70                      75                      80  
 Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
                          85                      90                      95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
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Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Ser Met Ala Cys Thr Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu

355

360

365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
 370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
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Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
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Asn Tyr Cys Leu Ile Cys Trp Lys  
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Ala Gln Val Thr Asp Glu Glu Ala Leu Ala Glu Arg Leu Ala Gln Gly  
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Pro Ile Ala Leu Ser Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
 50 55 60

Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
 85 90 95

Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
 100 105 110

Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
 130 135 140

His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
145 150 155 160

Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
165 170 175

Leu Leu Gln Gly Tyr Ser Phe Ala Cys Leu Asn Lys Gln Tyr Gly Val  
180 185 190

Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
195 200 205

Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
210 215 220

Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
225 230 235 240

Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
245 250 255

Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
260 265 270

Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
275 280 285

Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
325 330 335

Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
340 345 350

Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
355 360 365

Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
370 375 380

Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
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Glu Asp Arg Leu Phe Gly Arg Phe Thr Leu Leu Arg Arg Gly Lys Lys  
Page 70

405

410

415

Asn Tyr Cys Leu Ile Cys Trp Lys  
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Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
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Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
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Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
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Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
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Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
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Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
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Leu Asn Arg Glu Asp Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
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Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
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Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
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Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
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Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
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Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
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Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
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Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
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Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
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Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
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Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
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Pro Ile Ala Leu Ile Cys Gly Phe Asp Pro Thr Ala Asp Ser Leu His  
 35 40 45

Leu Gly His Leu Val Pro Leu Leu Cys Leu Lys Arg Phe Gln Gln Ala  
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Gly His Lys Pro Val Ala Leu Val Gly Gly Ala Thr Gly Leu Ile Gly  
 65 70 75 80

Asp Pro Ser Phe Lys Ala Ala Glu Arg Lys Leu Asn Thr Glu Glu Thr  
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Val Gln Glu Trp Val Asp Lys Ile Arg Lys Gln Val Ala Pro Phe Leu  
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Asp Phe Asp Cys Gly Glu Asn Ser Ala Ile Ala Ala Asn Asn Tyr Asp  
 115 120 125

Trp Phe Gly Asn Met Asn Val Leu Thr Phe Leu Arg Asp Ile Gly Lys  
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His Phe Ser Val Asn Gln Met Ile Asn Lys Glu Ala Val Lys Gln Arg  
 145 150 155 160

Leu Asn Arg Glu Gly Gln Gly Ile Ser Phe Thr Glu Phe Ser Tyr Asn  
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Leu Leu Gln Gly Tyr Gly Met Ala Cys Ala Asn Lys Gln Tyr Gly Val  
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Val Leu Gln Ile Gly Gly Ser Asp Gln Trp Gly Asn Ile Thr Ser Gly  
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Ile Asp Leu Thr Arg Arg Leu His Gln Asn Gln Val Phe Gly Leu Thr  
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Val Pro Leu Ile Thr Lys Ala Asp Gly Thr Lys Phe Gly Lys Thr Glu  
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Gly Gly Ala Val Trp Leu Asp Pro Lys Lys Thr Ser Pro Tyr Lys Phe  
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Tyr Gln Phe Trp Ile Asn Thr Ala Asp Ala Asp Val Tyr Arg Phe Leu  
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Lys Phe Phe Thr Phe Met Ser Ile Glu Glu Ile Asn Ala Leu Glu Glu  
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Glu Asp Lys Asn Ser Gly Lys Ala Pro Arg Ala Gln Tyr Val Leu Ala  
290 295 300

Glu Gln Val Thr Arg Leu Val His Gly Glu Glu Gly Leu Gln Ala Ala  
305 310 315 320

Lys Arg Ile Thr Glu Cys Leu Phe Ser Gly Ser Leu Ser Ala Leu Ser  
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Glu Ala Asp Phe Glu Gln Leu Ala Gln Asp Gly Val Pro Met Val Glu  
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Met Glu Lys Gly Ala Asp Leu Met Gln Ala Leu Val Asp Ser Glu Leu  
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Gln Pro Ser Arg Gly Gln Ala Arg Lys Thr Ile Ala Ser Asn Ala Ile  
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Thr Ile Asn Gly Glu Lys Gln Ser Asp Pro Glu Tyr Phe Phe Lys Glu  
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 O-methyl-L-tyrosine, or p-iodo-L-phenylalanine) or tryptophan,  
 tyrosine, or leucine

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 Val Xaa Gly Ser Ile Lys  
 1 5

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